Space Weather Technical Forecast

Issued on Saturday, 06 July 2024 at 00:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with a number of C-class class flares with the largest reaching C9.4 at 05/1903UTC. There are nine sunspot regions on the disc. AR3733 in the northwest remains the largest grouping. AR3729 remains a relatively open E-group, with signs of decay in trailing spots. AR3738 rotating across around the eastern limb shows increasing complexity and is the second largest group, but remains difficult to analyse. All other groups were relatively stable or weakening. No Earth-directed Coronal Mass Ejections (CMEs) have been observed during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were at Slow-Ambient levels, around 350 km/s. The solar wind density remained near or below average levels. The Interplanetary Magnetic Field (IMF), Bt, was weak to moderate, peaking just shy of 12 nT around 05/0530 UTC. The north-south component, Bz, varied weakly between +8 and -7 nT. The phi angle was resolutely positive (away from the Sun). Geomagnetic activity was Quiet-Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at Background levels.
High energy electron flux (greater than 2MeV) observed by GOES16 remained at background through the period. The 24-hour fluence was below Active on a declining trend, with 1.56e6 integrated pfu observed at 06/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a flat daily Chance of further isolated M-class flares, perhaps most likely from AR3733. Upcoming sunspot region arrivals over the eastern solar horizon in the period should help compensate for western limb losses.

Solar Wind / Geomagnetic Activity: No CMEs feature in the forecast.
Geomagnetic activity is expected to persist as Quiet to Unsettled (Kp0-3) through the next four days, with the greatest chance of departure from this being over the UTC weekend, with a Slight Chance of isolated Active (Kp4) intervals due to a possible connection to a small northern coronal hole.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at Background levels.
High energy electron flux is most likely to peak at Moderate levels over the coming days with a gradual decreasing trend, and only a Slight Chance of reaching Active electron fluence.

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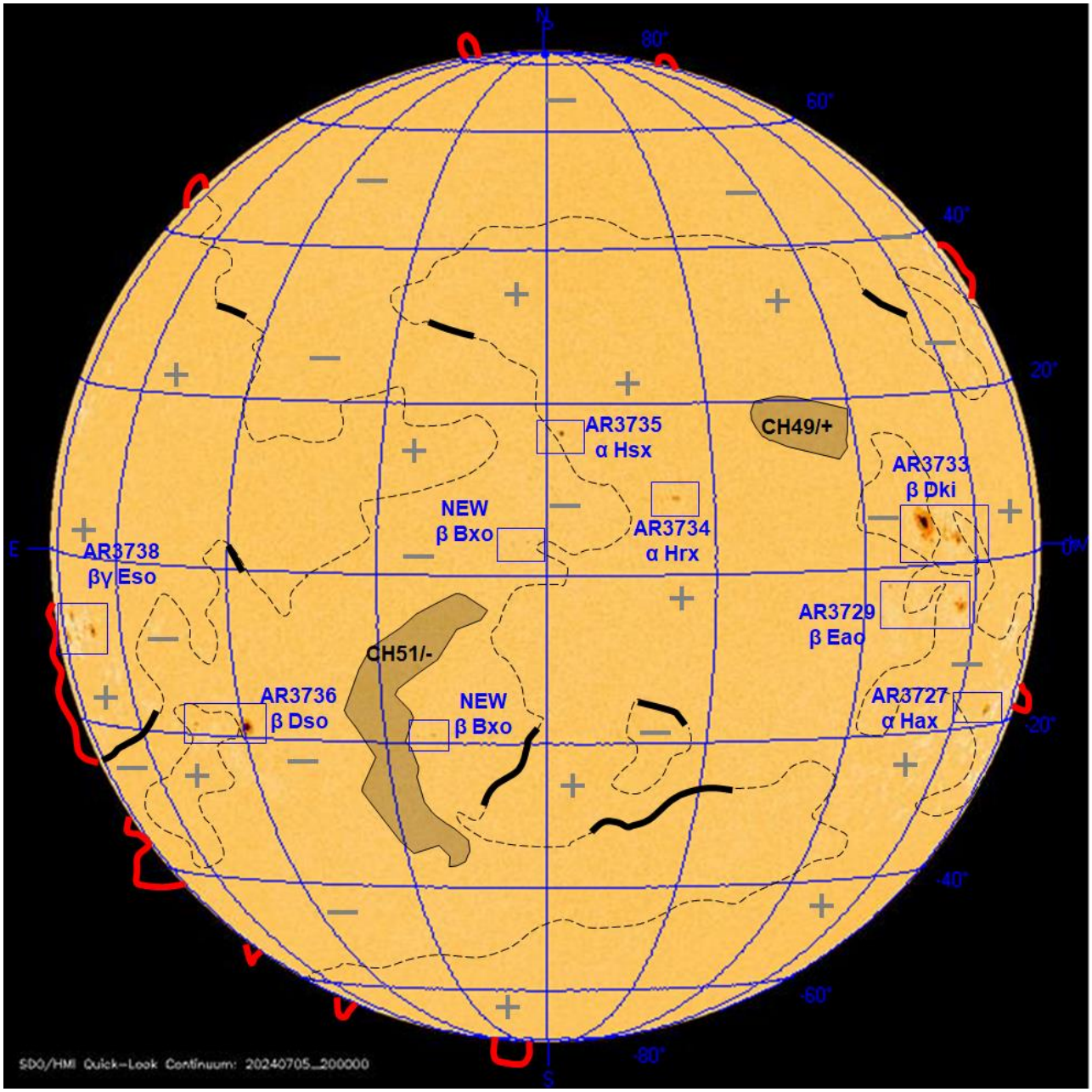
Figure 1. Solar Analysis Valid 2000 UTC, 5 July 2024.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

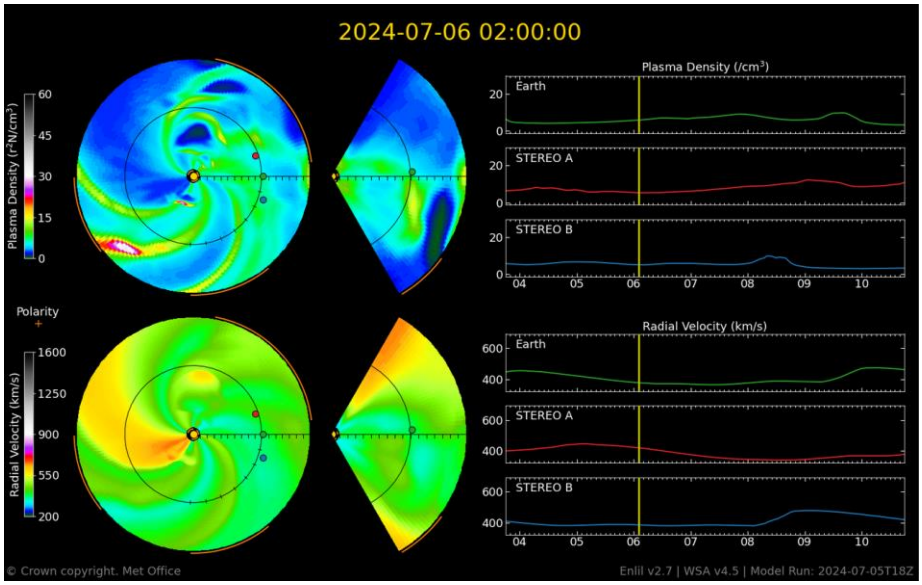
No Earth-directed CMEs feature in the forecast.
In the likely absence of any CME arrival, the solar wind is most likely to follow a slow-ambient regime throughout the four-day period. The main uncertainty in this regard is a returning but now very tenuous coronal hole (CH49/+ in the northwest). This has apparently further closed in EUV (e.g. AIA211) in the past 36-hour period, being increasingly eclipsed by bright flux to its east. Even with this trend, the emanating and potentially Earth-affecting solar wind from CH49/+ will have departed prior to this occurring and this is the basis for maintaining a small chance of slightly elevated or perhaps elevated wind speeds either late Day 1 or early Day 2 (06 or 07 Jul). Geomagnetic activity is expected to persist as Quiet to Unsettled (Kp 0-3) through the next four days, with the greatest chance of departure from this being over the UTC weekend, with a Slight Chance of an isolated Active (Kp4) interval.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth-directed CMEs are expected.

Figure 2: MOSWOC Enlil model looks to be providing good guidance currently. A possible Connection to CH49/+ is hinted at over the next 24 hours.



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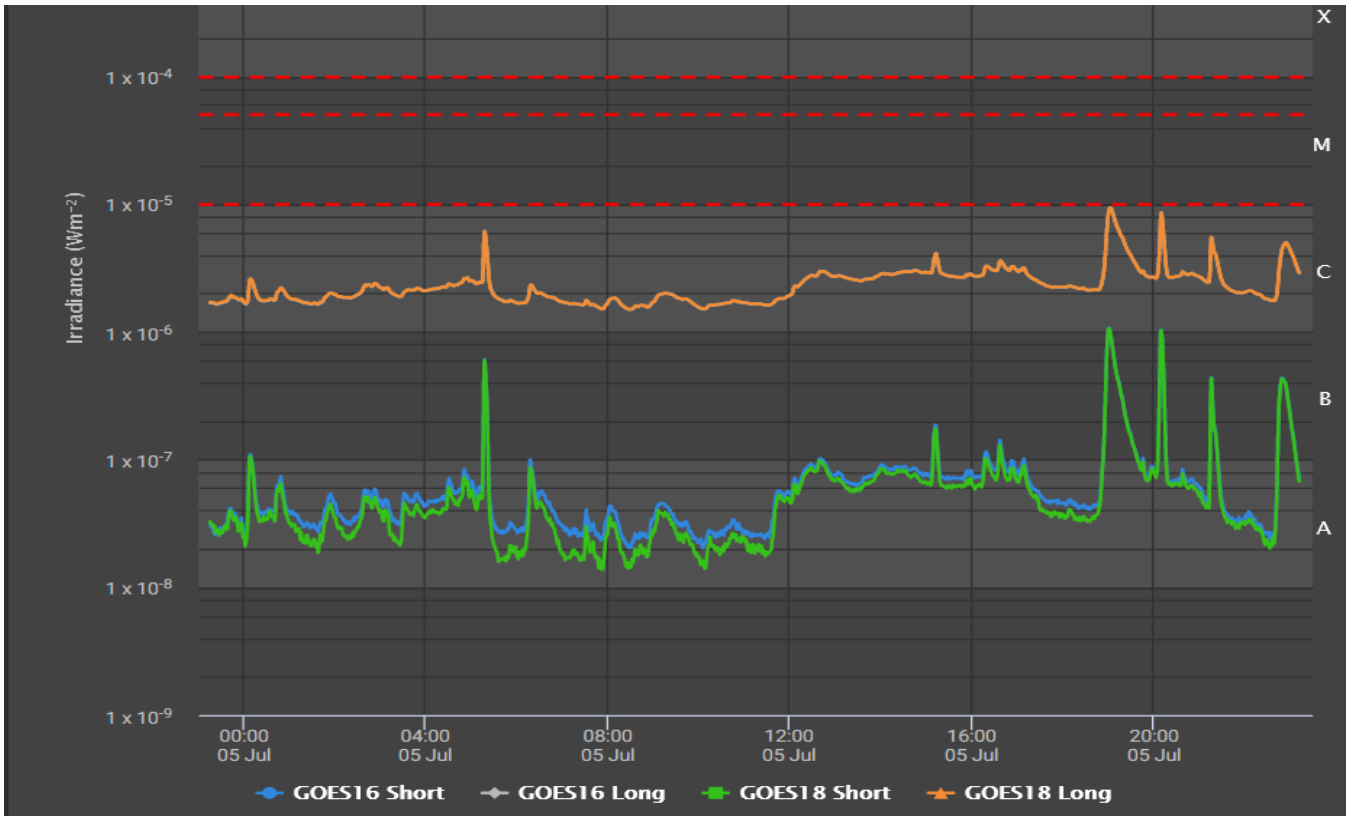
Radio Blackouts - X-Ray Flares:
Despite the presence of nine sunspot regions on the disc solar activity is now at Low levels AR3733 in the northwest remains the largest grouping. AR3729 remains a relatively open E-group, with signs of decay in trailing spots. AR3738 rotating across around the eastern limb shows increasing complexity and is the second largest group, but remains difficult to analyse. With the largest grouping AR3733 remaining on the disc then this probably maintains the greatest threat for any significant flaring for the next couple of days. Thereafter probabilities have been reduced a touch. Further flaring may also be in evidence from recent sunspots that have rotated across the western limb and are no longer visible. Expected upcoming sunspot region arrivals over the eastern solar horizon in the period could help compensate for western limb losses.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16 & -18 X-ray flux with C-class flares evident over past 24 hours.



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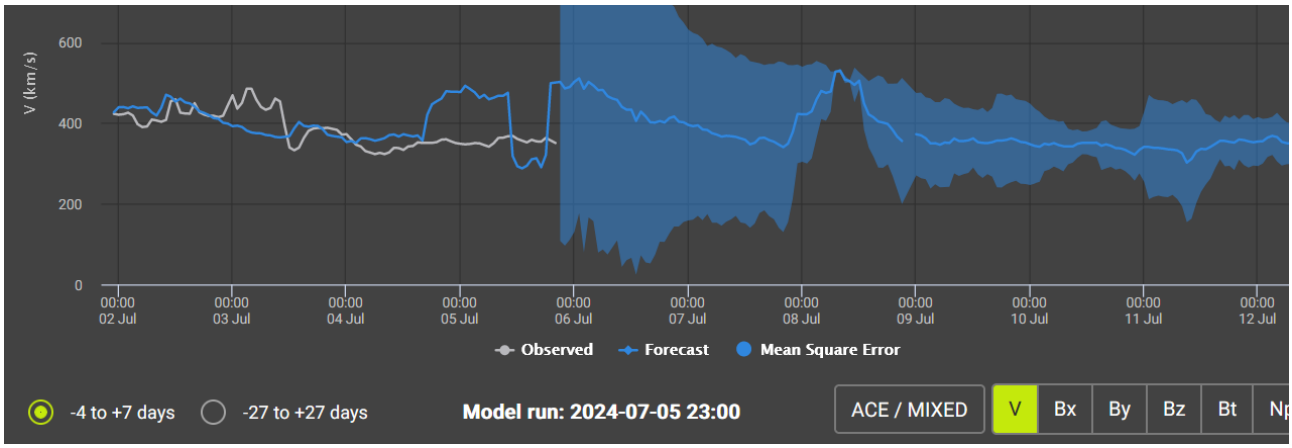
Solar Radiation Storms - (High Energy Protons):
There has been little recent response in GOES18 high energy proton flux measurements to low-level M-class flares of late. However many of the more complex sunspot regions on the disc are now nearing the better-connecting western portion of the disc, leading to a Slight Chance of S1 or greater as these groups round the western limb

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Latest Met Office SWPM output with no significant changes to solar winds anticipated.



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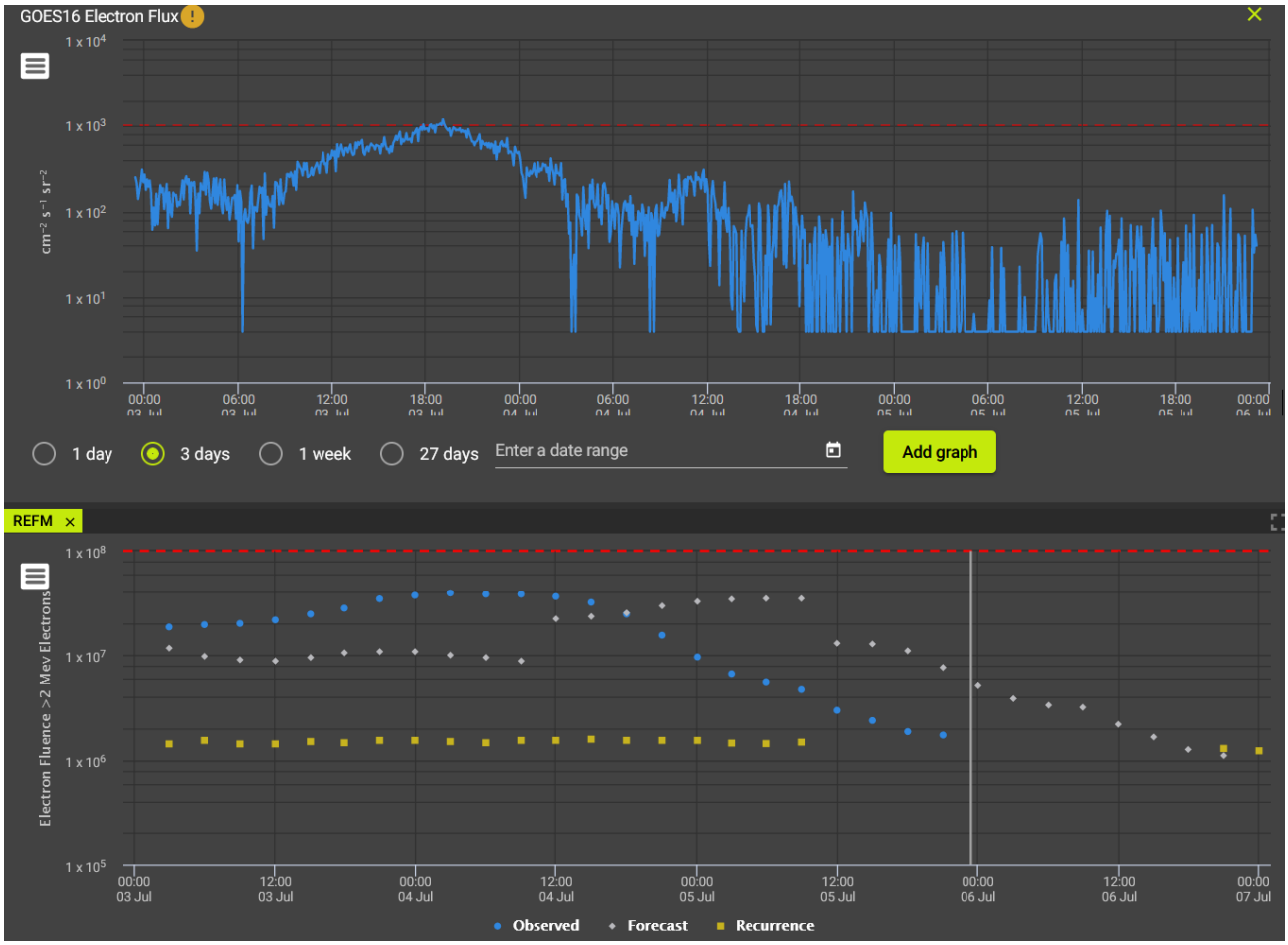
High Energy Electrons Event (≥ 2MeV):
High energy electron flux recorded at GOES16, has shown muted activity and with the strong possibility of no further drivers for increasing electron populations in the period, the most probable evolution is for a slow erosion of the current GOES16 trace in the slow solar wind environment. The main question mark as to this continuing is the possible presence of CH49/+ over the UTC weekend, with uncertainty increasing as levels perhaps take a temporary dip at GEO, with an uncertain but probably muted recovery in fluence into the new UTC working week. The MOSWOC REFM output is considered good guidance, with a generally flat trend indicated through the guidance period.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: High energy electron flux at GEO and Met Office REFM output.



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